Perfluoroelastomer 8580

Perfluoroelastomer 8580 is a perfluoroelastomer (FFKM) offering a significantly wider operational range and superior compression set resistance than any other perfluoroelastomer, thanks to its unique peroxide curing system that does not need any coagent (TAIC or

equivalent) for curing to be carried out. It can offer a very broad chemical resistance in a wide variety of media including acids, caustics, ketones,

aldehydes, esters, ethers, methanol, solvents, sour gases, hydrocarbons, steam, hot water and mixed process streams along with excellent thermal resistance.

Perfluoroelastomer 8580 is suitable for most applications in temperature ranging from – 10 ℃ to 300 ℃. Because of its specific proprietary cross-linking agent, **Perfluoroelastomer 8580** outperforms triazine cured FFKMs in high temperature water and steam, up to 300 ℃.

Perfluoroelastomer 8580 can be combined with other typical fluoroelastomer compounding ingredients; its mixing can be accomplished with two roll mills or internal mixers.Finished goods may be produced by a variety of rubber processing methods.

The primary use for **Perfluoroelastomer 8580** is the manufacturing of any kind of elastomeric sealing element such as Orings, gaskets, valve bodies, butterfly valves, pump housings and stators, metal bonded parts, diaphragms, profiles, etc. These sealing elements can be used in mechanical seals, pumps, compressors, valves, reactors, mixers, sprayers, dispensers, quick connect couplings, controls, instrumentation, etc. in chemical and petrochemical industry, hydrocarbon processing, petroleum exploration and extraction, food processing, pharmaceutical and bio analytical industry, aerospace and semiconductor manufacturing industries.

Perfluoroelastomer 8580 is registered in the FDA Inventory of Effective Premarket Notifications for Food Contact Substances. It can be compounded so that the finished gaskets or seals can be used in food processing equipments (see “food processing compounds” section below).

Perfluoroelastomer 8580 is marketed in the form of raw polymer (1 kg and 5 kg boxes) in order to give the transformer the freedom and the opportunity to develop and fine tune compounds and items best suited to produce high performance rubber articles such as Orings, seals, diaphragms and other parts used in process industries.

Handling and safety

Normal care and precautions should be taken to avoid skin contact, eye contact and breathing of fumes. Smoking is prohibited in working areas. Wash hands before eating or smoking. For complete health and safety information, please refer to the material safety data sheet.

Basic characteristics of the raw polymer are as follows

Property	Typical Value	Unit	Test Method
ML (1+10’) at 121 °C	75	MU	ASTM D1646
Specific gravity	2.05	g/cm 3	ASTM D792
Colour	Translucent		
Packaging / Form	1 kg and 5 kg / slabs		

Typical black compounds

Test Compound	Unit	70 Shore A	70 Shore A	80 Shore A	Test Method
Perfluoroelastomer 8580	phr	100	100	100	
Luperox ® 101XL-45	phr	1.5	1.5	1.5	
ZnO	phr	5	–	5	
Austin Black 325	phr	10	12	15	
N-990 MT Carbon Black	phr	10	12	15	
MADI LI01S	phr	–	–	0.3	
Armeen ® 18D	phr	–	–	0.3	

HENGSHUI CHUANGCHENG SEALING TECHNOLOGY CO., LTD.

Perfluoroelastomer 8580

Property	Unit	70 Shore A	70 Shore A	80 Shore A	Test Method
Mooney viscosity					
ML (1+10') at 121 ℃	MU	108	115	120	ASTM D1646
Compound density	g/cm 3	1.99	1.94	1.98	ASTM D1646
MDR 12 min at 170 ℃ arc 0.5 °					ASTM D6601
Minimum torque	lb ·in	2.7	2.9	3.3	
Maximum torque	lb ·in	21.1	19.7	29.7	
t s2	s	55	62	49	
t' 50	s	123	138	124	
t' 90	s	364	348	276	
Post cure: (8+16) h at 290 ℃					
100 % modulus	MPa	6.9	7.7	13.6	ASTM D412C
Tensile strength	MPa	18.3	17.0	16.5	
Elongation at break	%	224	202	130	
Hardness	Shore A	72	73	80	ASTM D2240
Compression set					ASTM D395
25 % deformation, O-ring #214					method B
70 h at 200 ℃	%	21	23	23	ASTM D412C

Compression set resistance

Test Compound	Typical Value	Unit	Test Method
Perfluoroelastomer 8580	100	phr	
Luperox ® 101XL-45	1.5	phr	
ZnO	5	phr	
Austin Black 325	8	phr	
N-990 MT Carbon Black	7	phr	

Property	Typical Value	Unit	Test Method
Post cure: (8+16) h at 290 ℃			
100 % modulus	6.3	MPa	ASTMD412C
Tensile strength	18.0	MPa	
Elongation at break	207	%	
Hardness	68	Shore A	ASTM D2240
Compression set			ASTM D395
25 % deformation, O-ring #214			method B

70 h at 23 ℃	25	%
70 h at 100 ℃	18	%
70 h at 200 ℃	18	%
70 h at 225 ℃	30	%
70 h at 250 ℃	39	%
70 h at 275 ℃	50	%
70 h at 300 ℃	58	%
70 h at 316 ℃	67	%
336 h at 200 ℃	30	%

Heat aging

Test Compound	Typical Value	Unit	Test Method
Perfluoroelastomer 8580	100	phr	
Luperox ® 101XL-45	1.5	phr	
ZnO	5	phr	
Austin Black 325	8	phr	
N-990 MT Carbon Black	7	phr	

Property	Unit	70h	168h	336h	1000h	Test Method
Heat aging at 250 ℃						ASTM D573
Δ Tensile strength	%	–1	–2	–13	–24	
ΔElongation at break	%	7	12	19	30	
ΔHardness	Shore A	–1	–2	–2	–2	
ΔWeight	%	–0.7	–1.3	–1.7	–2.2	
Heat aging at 275 ℃						ASTM D573
Δ Tensile strength	%	–1	–18	–30	–40	
ΔElongation at break	%	20	35	45	65	
ΔHardness	Shore A	–1	–2	–3	–4	
ΔWeight	%	–1.1	–2.0	–3.1	–3.6	
Heat aging at 300 ℃						ASTM D573
Δ Tensile strength	%	–20	–39	–50	–	
ΔElongation at break	%	40	62	85	–	

ΔHardness	Shore A	–2	–3	–4	–
ΔWeight	%	–2.1	–3.1	–4.0	–

High temperature steam resistant compound

Test Compound	Typical Value	Unit	Test Method
Perfluoroelastomer 8580	100	phr	
Luperox ® 101 (92 %)	1	phr	
Austin Black 325	15	phr	
N-990 MT Carbon Black	15	phr	
Armeen ® 18D	0.5	phr	
Property	**Typical Value**	**Unit**	**Test Method**
MDR 12 min at 170 ℃ arc 0.5 °			ASTM D6601
Minimum torque	28	lb ·in	
Maximum torque	26.1	lb ·in	
t s2	46	s	
t' 50	94	s	
t' 90	188	s	
Post cure: (8+16) h at 200 ℃			
100 % modulus	11.0	MPa	ASTM D412C
Tensile strength	14.5	MPa	
Elongation at break	164	%	
Hardness	79	Shore A	ASTM D2240
Compression set			ASTM D395
25 % deformation, O-ring #214			method B
70 h at 200 ℃	19	%	
70 h at 300 ℃	41	%	
Steam, 168 h at 300 ℃			ASTM D471
Δ Tensile strength	11	%	
Δ Elongation at break	-17	%	
Δ Hardness	0	Shore A	
Δ Weight	-0.8	%	

Oil & gas compound

Test Compound	Typical Value	Unit	Test Method
Perfluoroelastomer 8580	100	phr	
Luperox ® 101XL-45	1.5	phr	
N-990 MT Carbon Black	60	phr	
PAT 777	1	phr	
Struktol ® WS 280	0.5	phr	
Property	**Typical Value**	**Unit**	**Test Method**
MDR 12 min at 170 ℃ arc 0.5 °			ASTM D6601
Minimum torque	4.2	lb ·in	
Maximum torque	31.2	lb ·in	
t s2	45	s	
t' 50	125	s	
t' 90	290	s	
Post cure: (8+16) h at 250 ℃			
50 % modulus	9.8	MPa	ASTM D412C
100 % modulus	16.7	MPa	
Tensile strength	18.4	MPa	
Elongation at break	125	%	
Hardness	93	Shore A	ASTM D2240
Compression set			ASTM D395
25 % deformation, O-ring #214			method B
70 h at 200 ℃	27	%	

Rapid gas decompression tests

The typical oil & gas Perfluoroelastomer 8580 compound on page 6 was successfully tested in the following conditions referring to EN ISO 23936-2 standard ‘Petroleum, petrochemical and natural gas industries – Non-metallic materials in contact with media related to oil and gas production Part 2: Elastomers” and successfully passed the Rapid Decompression Test.

Property	Typical Value	Unit	Test Method
Gas	90/10 CH 4 /CO 2	mol %	
O-ring replication	4		
Groove fill	65	%	
Temperature	100	℃	
Pressure	150	bar	

Number of cycles	8	
First cycle duration	min. 68	h
Soak time	min. 6	h
Hold period between cycles	1	h
De-pressurization rate	20	bar/minute

O-rings #312 (13.64 mm internal diameter – 5.33 mm cross-section) were submitted to testing.

All O-rings met the ISO 23936-2 acceptance criterion after the 8 cycle RGD test, since the ratings were as below:

ISO 23936 rating: 1000, 0000, 1100, 0000

whereby the ISO 23936 rating numbers are as follows:

0: no cracks, holes or blisters; the exposed surface is intact.

1: any number of cracks, each < 25 % CSD: total crack length shall not exceed CSD. External cracks shall be < 10 % CSD; no splits permitted.

Aerospace compound

		AMS 7257C		
Test Compound	**Actual Value**	**Specification**	**Unit**	**Test Method**
Perfluoroelastomer 8580	100		phr	
Luperox ® 101 (92 %)	1		phr	
N-990 MT Carbon Black	30		phr	

		AMS 7257C		
Property	**Actual Value**	**Specification**	**Unit**	**Test Method**
MDR 12 min at 170 ℃ arc 0.5 °				ASTM D6601
Minimum torque	2.3		lb ·in	
Maximum torque	24.2		lb ·in	
t s2	45		s	
t' 50	100		s	
t' 90	245		s	
Post cure: (8+16) h at 290 ℃				
100 % modulus, O-ring #214	9.8		MPa	ASTM D412C
Tensile strength, O-ring #214	18.6	> 10.3	MPa	
Elongation at break, O-ring #214	155	> 120	%	
Hardness, slabs	75	70 to 80 Shore A		ASTM D2240
Compression set				ASTM D395
O-ring #214				method B

70 h at 200 ℃	18		%	
70 h at 230 ℃	20	< 40	%	
336 h at 230 ℃	28		%	
70 h at 300 ℃	28		%	
TR 10	-1	< 5	%	ASTM D1329

Dry heat resistance

AMS 7257C

Test Compound	Actual Value	Specification	Unit	Test Method
Heat aging, 70 h at 290 ℃				ASTM D573
Δ Tensile Strength	-17	> – 20	%	
Δ Elongation at break	-3	> – 15	%	
Δ Hardness	-1	– 5 to 5	Shore A	
Weight loss	0.3	0 to 5	%	

Aromatic fuel resistance

AMS 7257C

Property	Actual Value	Specification	Unit	Test Method
Fuel B, 70 h at 23 ℃				ASTM D573
Δ Tensile Strength	4	> – 20	%	
Δ Elongation at break	-2	> – 15	%	
Δ Hardness	1	– 5 to 5	Shore A	
Δ Volume	0.2	0 to 5	%	

Hydraulic fluid resistance

AMS 7257C

Property	Actual Value	Specification	Unit	Test Method
Skydrol ® LD4, 70 h at 125 ℃				ASTM D471
Δ Tensile Strength	-19	> – 40	%	
Δ Elongation at break	14	> – 15	%	
Δ Hardness	-4	– 15 to 0	Shore A	
Δ Volume	4.6	0 to 5	%	

Synthetic lubricant resistance

AMS 7257C

Property	Actual Value	Specification	Unit	Test Method
Reference oil 300, 70 h at 175 ℃				ASTM D471
Δ Tensile Strength	-9	> – 10	%	
Δ Elongation at break	6	> – 15	%	
Δ Hardness	-2	– 15 to 5	Shore A	
Δ Volume	0.6	0 to 5	%	

Perfluoroelastomer 8580, when properly formulated, meets the requirements of Aerospace Material Specification AMS 7257C. It offers outstanding thermal stability, excellent compression set resistance as well as excellent resistance to aromatic fuels, hydraulic fluids and gas turbine engine lubricating oils.

Food processing compounds

Perfluoroelastomer 8580 is registered in the FDA Inventory of Effective Food Contact Substances (FCS) Notifications, being the subject of Food Contact Notification (FCN #126), with an effective date July 21, 2001. See the list of effective notifications for FCN available on the Agency's web site at: http://www.accessdata.fda.gov/scripts/fdcc/?set=FCN

The finished compounds are intended for repeated use as components of gaskets or seals used in food processing equipment intended to contact food Types I through VII as described in Table 1 of 21 CFR 176.170(c) as follows:

Table 1: Types of Raw and Processed Foods

I. Nonacid, aqueous products; may contain salt or sugar or both (pH above 5.0)

II. Acid, aqueous products; may contain salt or sugar or both, and including oil-in-water emulsions of low- or high-fat content

III. Aqueous, acid or nonacid products containing free oil or fat; may contain salt, and including water-in-oil emulsions of low- or high-fat content

IV. Dairy products and modifications:

A Water-in-oil emulsions, high- or low-fat

B Oil-in-water emulsions, high- or low-fat

V. Low-moisture fats and oil

VI. Beverages:

A Containing up to 8 percent of alcohol

B Non-alcoholic

C Containing more than 8 percent alcohol

VII. Bakery products other than those included under Types VIII or IX of this table:

A Moist bakery products with surface containing free fat or oil

B Moist bakery products with surface containing no free fat or oil

VIII. Dry solids with the surface containing no free fat or oil (no end test required)

IX. Dry solids with the surface containing free fat or oil

Data for establishing compliance with the FDA standards for Perfluoroelastomer 8580 based compounds were obtained from cured items having the formulation shown below:

Perfluoroelastomer 8580 100 phr

Luperox ® 101XL-45 1.5 phr

Extraction tests were performed on slabs that were press- cured for 10 min at 170 ℃, followed by an oven post-cure of 24 h at 200 ℃.

Compounding guidelines for food processing

To design FDA compliant compounds, some restrictions have to be taken into account as far as the curatives, the fillers and the process aids are concerned.

1. Curatives

the following restrictions apply in terms of curatives amount:

Perfluoroelastomer 8580 100 phr

Luperox ® 101XL-45 ≤ 1.5 phr

2. Fillers

The following fillers are approved for use in items intended for repeated food contact use, under 21 CFR 177.2600, section v., and provide at the same time excellent processing behaviour and physical properties:

• Barium sulfate

• Silica

• Titanium dioxide

• Carbon black

(channel process or furnace combustion process; total carbon black not to exceed 50 % by weight of rubber product; furnace combustion black content not to exceed 10 % by weight of rubber products intended for use in contact with milk or edible oils)

3. Process aids

• Carnauba wax

• Struktol ® HT 290

(concentration must not exceed 5 % by weight of the rubber compound)

White food processing compounds

Test Compound	Unit	70 Shore A	70 Shore A	Test Method
Perfluoroelastomer 8580	phr	100	100	

Luperox ® 101XL-45	phr	1.5	1.5	
BaSO 4 (Blanc Fixe HD 80)	phr	40	–	
SiO 2 (Ultrasil ® 360)	phr	–	10	
TiO 2 (Ti-Pure ® R-960)	phr	5	5	
Property	**Unit**	**70 Shore A**	**70 Shore A**	**Test Method**
Mooney viscosity ML (1+10') at 121 °C	MU	93	96	ASTM D1646
Compound density MU	g/cm 3	2.44	2.08	
MDR 12 min at 170 ℃ arc 0.5 °				ASTM D6601
Minimum torque	lb ·in	2.7	2.8	
Maximum torque	lb ·in	18.2	17.3	
t s2	s	42	45	
t' 50	s	83	82	
t' 90	s	214	197	
Post cure: (8+16) h at 250 ℃				
100 % modulus	MPa	5.6	5.3	ASTM D412C
Tensile strength	MPa	15.6	19.9	
Elongation at break	%	280	218	
Hardness	Shore A	75	69	ASTM D2240
Compression set				ASTM D395
25 % deformation, O-ring #214				method B
70 h at 200 ℃	%	20	25	

Low hardness – translucent compound

Test Compound	**Typical Value**	**Unit**	**Test Method**
Perfluoroelastomer 8580	100	phr	
Luperox ® 101 (92 %)	1	phr	
Property	**Typical Value**	**Unit**	**Test Method**
Perfluoroelastomer 8580	2.05	g/cm3	
MDR 12 min at 170 ℃ arc 0.5 °			ASTM D6601
Minimum torque	1.2	lb ·in	

Maximum torque	11.5	lb ·in	
t s2	70	s	
t' 50	101	s	
t' 90	192	s	
Post cure: (8+16) h at 250 ℃			
100 % modulus	1.5	Mpa	ASTM D412C
Tensile strength	11.4	Mpa	
Elongation at break	283	%	
Hardness	56	Shore A	ASTM D2240
Compression set			ASTM D395
25 % deformation, O-ring #214			method B
70 h at 200 ℃	35	%	

Cold flexibility

Property	Typical Value	Unit	Test Method
DSC			
T g onset	-7	℃	
T g midpoint	-1	℃	
Retraction curve			
TR 10	-1	℃	
TR 30	3	℃	
TR 50	6	℃	
TR 70	9	℃	

Test Compound	Typical Value	Unit	Test Method
Perfluoroelastomer 8580	100	phr	
Luperox ® 101XL-45	1.5	phr	
ZnO	5	phr	
Austin Black 325	8	phr	
N-990 MT Carbon Black	7	phr	

Property	Typical Value	Unit	Test Method
Brittleness temperature			

100 % pass	-11	°C
50 % pass	-17	°C

Fluid resistance overview

Fluid	Volume Swelling
Inorganic acids	**< 10 %**
Organic acids	**< 10 %**
Alkalis	**< 10 %**
Amines (RT)	**< 10 %**
Hot amines (> 70 °C)	**30-50 %**
Water / Steam	**< 10 %**
Ketones	**< 10 %**
Esters	**< 10 %**
Esters	**< 10 %**
Aldehydes	**< 10 %**
Alcohols	**< 10 %**
Hydrocarbons	**< 10 %**
Sour gas	**< 10 %**
Lubricants	**< 10 %**
Fluorinated fluids	**30-50 %**

Fluid resistance

Acid fluids

For optimal acid resistance, zinc oxide and Wollastonite fillers are not recommended; white inert mineral fillers and carbon blacks should be selected in acidic and basic environments.

Property	Typical Value	Unit	Test Method
HCI, 37 %, 72 h at 80 °C			
Δ Tensile strength	– 4	%	
Δ Elongation at break	– 15	%	
Δ Hardness	-1	Shore A	
Δ Volume	1.6	%	

HF, 49 %, 720 h at 23 ℃

Δ Tensile strength	5	%
Δ Elongation at break	– 23	%
Δ Hardness	0	Shore A
Δ Volume	0.3	%

Nitric acid, 65 %, 168 h at 80 ℃

Δ Tensile strength	– 30	%
Δ Elongation at break	5	%
Δ Hardness	– 10	Shore A
Δ Volume	10	%

Glacial acetic acid, 336 h at 100 ℃

Δ Tensile strength	– 35	%
Δ Elongation at break	– 3	%
Δ Hardness	– 10	Shore A
Δ Volume	7	%

KOH, 50 %, 168 h at 125 ℃

Δ Tensile strength	-10	%
Δ Elongation at break	-15	%
Δ Hardness	-2	Shore A
Δ Volume	0.4	%

Ethylene diamine, 504 h at 23 ℃

Δ Volume	1.8	%

Ethylene diamine, 336 h at 60 ℃

Δ Tensile strength	-15	%
Δ Elongation at break	-18	%
Δ Hardness	-7	Shore A
Δ Volume	15	%

2-(2-aminoethoxy) ethanol (diglycolamine), 168 h at 100 ℃

Δ Tensile strength	1	%
Δ Elongation at break	-4	%
Δ Hardness	-1	Shore A
Δ Volume	7	%

N-Methyldiethanolamine (MDEA), 168 h at 100 ℃

Δ Tensile strength	2	%
Δ Elongation at break	0	%
Δ Hardness	-2	Shore A
Δ Volume	4.6	%

Miscellaneous PFR properties

In general, the following properties can be considered as typical or average values for perfluoroelastomers.

Thermal expansion

Following the definition of linear coefficient of thermal expansion: L = L 0 · (1 + α · ΔT), the average value between 80 and 250 ℃ is as follows:

α = 3.5 ·10 –4 1/K

Specifi c heat

Temperature	Unit	Black Compound	White Compound	Test Method
50 ℃	J/g	0.98	0.83	
100 ℃	J/g	1.05	0.86	
150 ℃	J/g	1.12	0.91	

Gas permeation rate

Property	Permeability (T = 30 °C)	Unit	Test Method
Nitrogen	250	(cm 3 (STP) ·mm/m ²atm ·d)	
Oxygen	450	(cm 3 (STP) ·mm/m ²atm ·d)	
Helium	5400	(cm 3 (STP) ·mm/m ²atm ·d)	

Electrical properties

Dielectric constant and loss factor at 50 Hz frequency. Volume and surface resistivity were measured applying 100 V direct tension.

Property	Typical Value	Unit	Test Method
Dielectric constant ε'	3.50		
Loss factor tan(δ	0.030		

Surface resistivity R s	5.0 · 10 16 Ω
Volume resistivity R v	6.1 · 10 16 Ω · cm